

AERSCREEN: Status and Update

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Overview

- AERSCREEN workgroup
- Description and Features
- Initial test results
- MAKEMET
- AERSCREEN stages
- Questions

AERSCREEN Finalization Workgroup

- Jim Haywood, Chair, Michigan DEQ
- Karen Wesson, EPA
- Roger Brode, EPA (formerly with MACTEC)
- James Thurman, EPA
- Bob Paine, ENSR
- Lloyd Schulman, TRC
- Acknowledge Herman Wong, EPA Region 10

AERSCREEN: Description

- AERSCREEN is a DOS tool that runs AERMOD in a “screening” mode for a single source
 - calls MAKEMET, BPIPPRM and AERMAP to generate necessary AERMOD inputs
 - Spring 2008, incorporates output from AERSURFACE but does not currently call AERSURFACE
 - SCREEN option added to AERMOD in 1995 forces model to calculate centerline concentration for each source/receptor/meteorology combination
 - Output limited to to 1-hour averages and NOCHKD selected option to eliminate date sequence checking

AERSCREEN Features

- Program developed by Jim Haywood, MI DEQ
 - Data entered via prompts or by input file
 - Source types: point, volume, rectangular area, circular area, and flare
 - Flat or complex terrain
 - AERSCREEN calls AERMAP for complex terrain processing
 - Terrain not used for rectangular area sources
 - PRIME building downwash
 - Specify stack location and direction relative to building center
 - Specify building dimensions (height, horizontal dimensions)
 - Direction of long building dimension from north
 - Not used for area or volume sources
 - AERSCREEN calls BPIPPRM
 - No deposition
 - MAKEMET meteorology
 - Specify min and max temperatures, minimum wind speed, anemometer height and surface characteristics
 - Internal matrices of other meteorological parameters

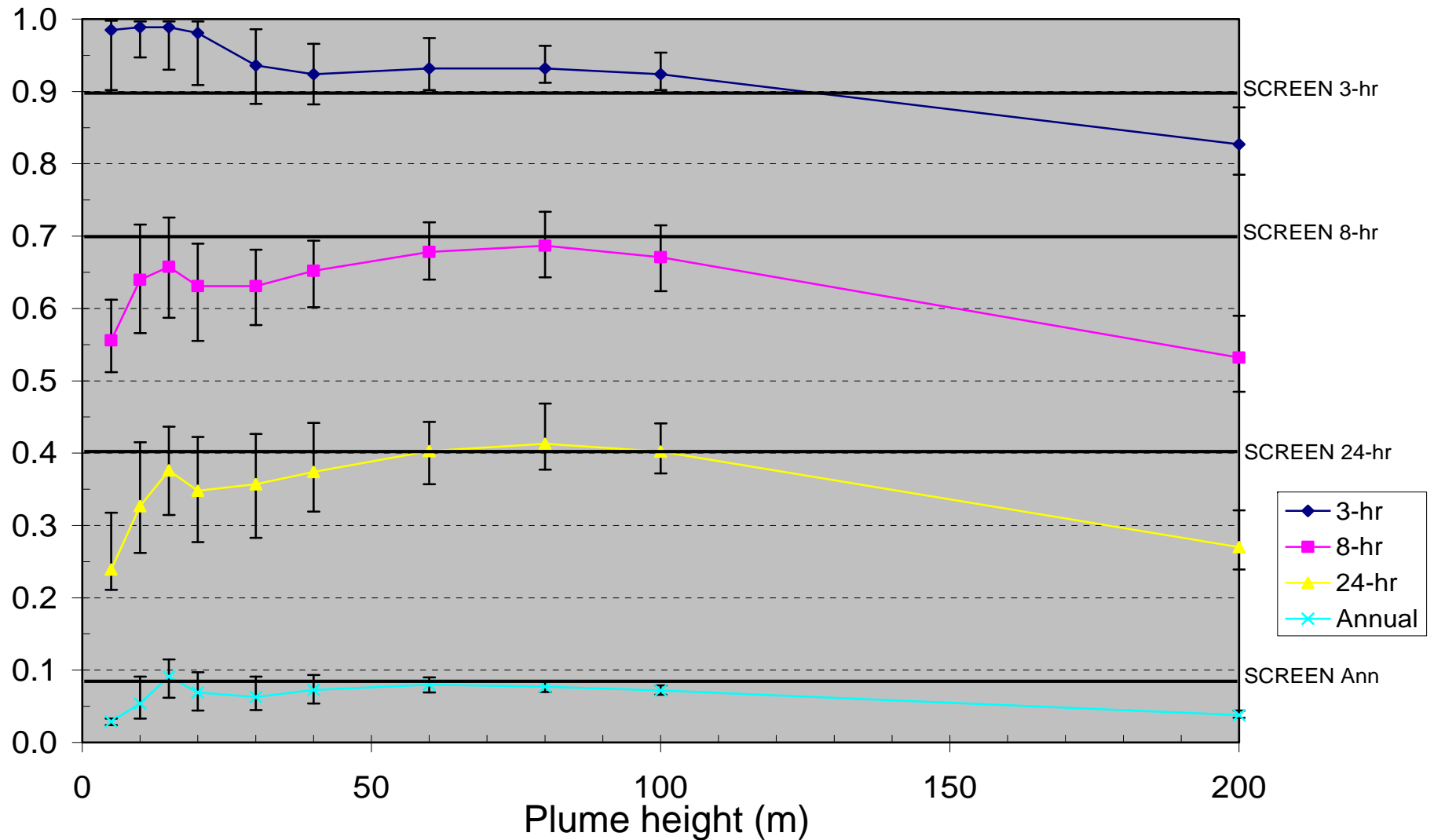
AERSCREEN Features

- User can specify
 - Probe distance for terrain processing
 - Default of 5 km for flat terrain (with or without building downwash) or rectangular area sources
 - Flagpole receptors
 - Elevation of source location for PROFBASE (even for flat terrain)
 - Elevation above sea level for potential temperature profile
 - Rural or urban (if urban, urban population)
 - Ambient air distance (fence line distance)
 - Source location in geographic or UTM coordinates
- Search routine to find worst case impact
 - RANKFILE output in AERMOD
 - Concentration, date, direction, distance, and meteorology

AERSCREEN Features

- Routine to find maximum concentration for automatic receptor distances
- Re-Use of Previous AERSCREEN Run Files
- Performs errors checks on AERMOD and AERMAP output and writes log file of AERSCREEN run
- Includes factors for 3-hour, 8-hour, 24-hour and annual averages – based on upper bound of SCREEN3 factors
 - 3-hour: 1.0 (0.90 ± 0.10)
 - 8-hour: 0.9 (0.70 ± 0.20)
 - 24-hour: 0.6 (0.40 ± 0.20)
 - Annual: 0.1 (0.08 ± 0.02)

Figure 1: AERSCREEN Averaging Period Ratios vs. Plume Height
(line shows 95th-percentile and error bars show 90th and 98th percentiles)



AERSCREEN Tests

- Significant testing to date shows good results across wide range of applications
- “Good” defined as reasonable conservatism compared to AERMOD refined estimates

Database	Type	No. of sources	Max. Ratio	Min. Ratio	Median Ratio
Jim Haywood	Miscellaneous	7	5.20	1.09	2.35
Karen Wesson	Stack downwash	32	2.54	0.96	1.17
Karen Wesson	Stack non-downwash	26	2.18	0.97	1.49
Roger Brode	Flat Terrain Non-downwash Rural & Urban	168	2.98	0.98	1.05
Roger Brode	Complex Terrain Varying Source/ Terrain Distance	168	4.56	0.96	1.18
Bob Paine	Complex Terrain	28	7.46	1.08	2.23

MAKEMET

- MAKEMET loops through several meteorological parameters:
 - Wind speed (stable and convective)
 - Cloud cover (stable and convective)
 - Max/min ambient temp (stable and convective)
 - Solar elevation angle (stable and convective)
 - Convective velocity scale (w^*) (convective only)
 - Mechanical mixing heights (stable only)
- Uses AERMET subroutines to calculate u^* and L , and also calculates convective mixing heights
- For AERSCREEN, uses wind direction of 270
- Generates surface and profile files for running AERMOD

Surface Characteristics and MAKEMET

- Three methods of surface characteristics into AERSCREEN
 1. User defined: annual, non-sector based
 2. Seasonal tables from AERMET User's Guide (Tables 4-1, 4-2, 4-3)
 - User specifies dominant land use type and moisture conditions
 - Water, deciduous forest, coniferous forest, swamp, cultivated land, grassland, urban, desert shrubland
 - Moisture for Bowen ratio: average, dry, or wet
 - Non-sector based
 3. AERSURFACE output
 - User enters AERSURFACE output filename or AERMET stage 3 input filename
 - Annual, seasonal, or monthly
 - 1 to 12 surface roughness sectors
 - AERSURFACE is run for the source location
- MAKEMET is run for each temporal, sector combination and met files generated for each combination

AERSCREEN Stages & Steps

User actions

Input and validate data

Generate meteorological files and run BPIPPRM and AERMAP for source if necessary

Program actions

Is there a source-receptor
direction
dependency?

No

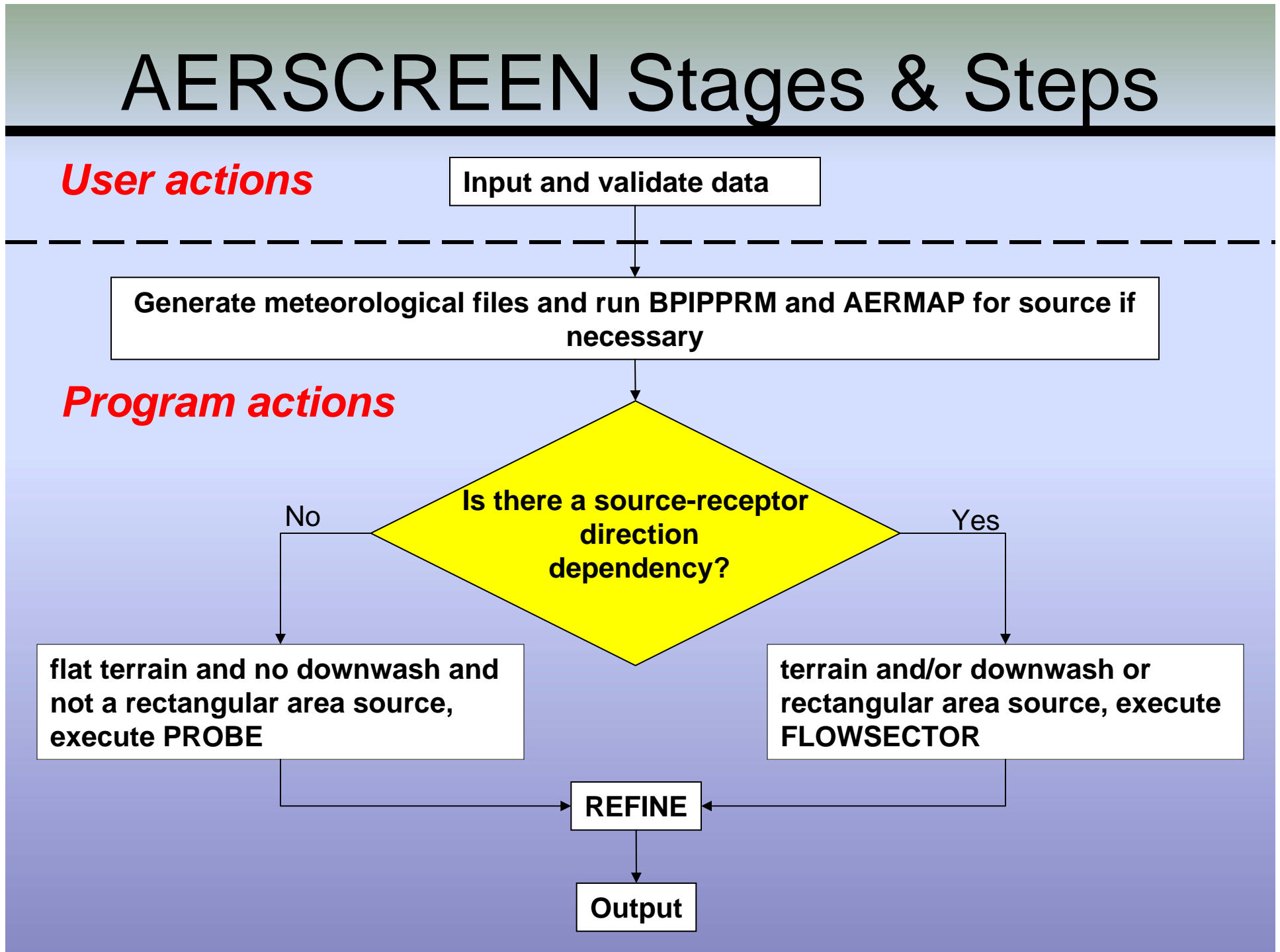
Yes

flat terrain and no downwash and
not a rectangular area source,
execute PROBE

terrain and/or downwash or
rectangular area source, execute
FLOWSECTOR

REFINE

Output



Example input file

```
Filter:  Refresh
Open Files
D:\ASCREEN\tests_070908\aesr

** Coordinates switched from NAD27 to NAD83
** Coordinates switched from geographic to UTM
** STACK DATA      Rate      Height      Diam.      Temp.      Velocity      Flow
**                0.1000E+03  10.0000    0.5000    300.0000    15.0000    6241.
** BUILDING DATA   BPIP      Height    Max dim.   Min dim.   Orient.      Direct.      Offset
**                Y          34.0000   120.0000   60.0000    90.0000     26.6000     67.0000
** MAKEMET DATA    MinT      MaxT      Speed      AnemHt     Surf Clim   Albedo      Bowen      Length      AERSURFACE FILE
**                261.40   313.10   1.5        10.000     9          1  0.1500    0.8500    0.3050     aersurface_12.out
** TERRAIN DATA    Terrain    UTM East   UTM North   Zone      Nada        Probe      PROFBASE   Use AERMAP   elev
**                Y          700196.9   3974235.8   17         4          1.0        126.80     N
** UNITS/POPULATION Units      R/U      Population      Amb. dist.   Flagpole     Flagpole height
**                M          U          2400000.        30.000       Y            1.00
** Temporal sector: Winter      , flow vector: 180 degrees, spatial sector: 12

CO STARTING
TITLEONE test
**          STAGE 3
MODELOPT CONC SCREEN
AVERTIME 1
URBANOPT 2400000.
POLLUTID OTHER
FLAGPOLE 1.00
RUNORNOT RUN
CO FINISHED

SO STARTING
LOCATION SOURCE POINT      0.0      0.0      126.80
SRCPARAM SOURCE  0.1000E+03  10.000  300.000  15.000  0.500
```

Ln 51, Col. 9, CW DOS Mod: 9/30/2008 4:20:44PM Bytes Sel: 1 INS

Validation page

```
C:\> Command Prompt - ..\AERSCREEN_ro_draft_08280.exe

AERSCREEN RODFT - beta release version

----- DATA ENTRY VALIDATION -----

** STACK DATA **
----- METRIC ----- ENGLISH -----
Emission Rate:      100.0000 g/s      793.651 lb/hr
Stack Height:       10.00 meters      32.81 feet
Stack Diameter:     0.500 meters      19.69 inches
Stack Temperature:  300.0 K           80.3 Deg F
Exit Velocity:      15.000 m/s        49.21 ft/s
Stack Flow Rate:    6240 ACFM
Model Mode:         URBAN
Population:         2400000
Dist to Ambient Air: 30.0 meters      98. feet
Flagpole Receptor Height: 1.0 meters      3. feet

** BUILDING DATA **
Building Height:     34.0 meters      111.5 feet
Max Building Dimension: 120.0 meters      393.7 feet
Min Building Dimension: 60.0 meters      196.9 feet
Building Orientation: 90.0 degrees
Stack Direction:     26.6 degrees
Stack Distance:      67.0 feet        219.8 meters

** TERRAIN DATA **
Source Longitude:    -78.78194 deg      700197. Easting
Source Latitude:     35.89194 deg      3974236. Northing
UTM Zone:            17                 Reference Datum: 4
Source Base Elevation: 126.8 meters      416.0 feet

Probe distance:      1000. meters      3281. feet

** METEOROLOGY DATA **
Min/Max Temperature: 261.4 / 313.1 K    10.9 / 103.9 Deg F
Minimum Wind Speed:   1.5 m/s
Anemometer Height:    10.000 meters

Using AERSURFACE output within aersurface_12.out

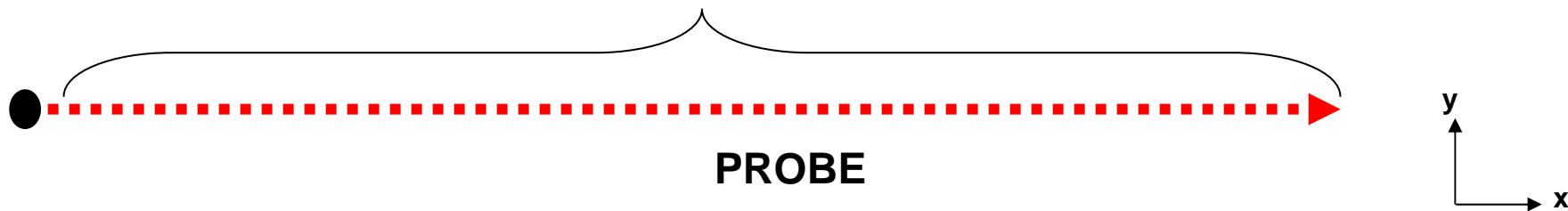
*** AERSCREEN Run is Ready to Begin - Choose Option to Proceed ***

1 - Change Source Data;
2 - Change Building Data;
3 - Change Terrain Data;
4 - Change Meteorology Data;
   - or -
Hit <Enter> to Start Run
```

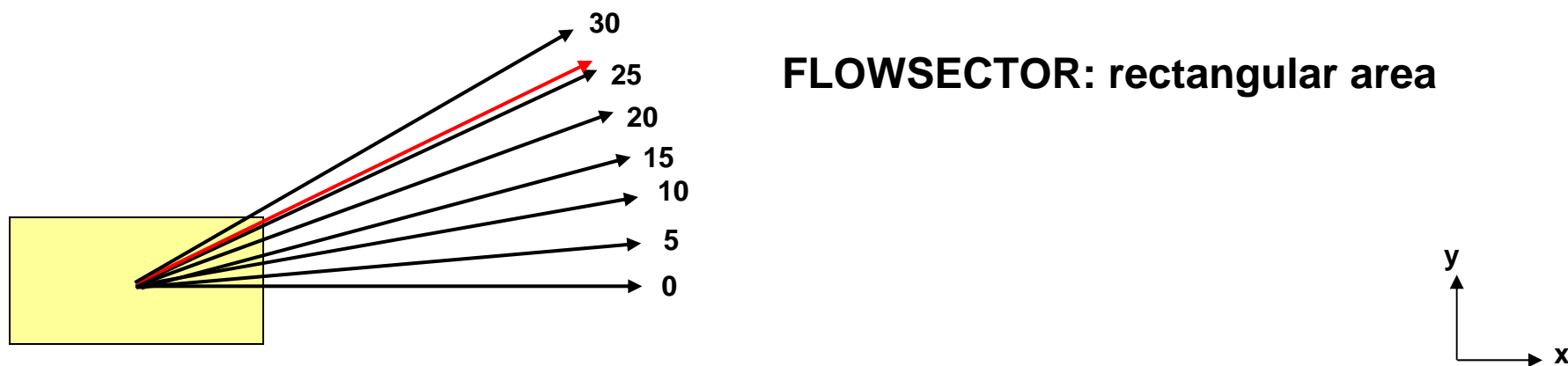
Summary of stages

- PROBE
 - 5 km default probe distance (25 m spacing) in one direction
 - AERMOD executed for each temporal/spatial sector of SC
- FLOWSECTOR
 - Rectangular area sources
 - 5 km probe distance (25 m spacing) for 5 degree diagonals
 - AERMOD run for each SC temporal/spatial sector for each diagonal
 - Other sources
 - Receptors every 10 degrees out to probe distance
 - Direction specific terrain and projected building dimensions used
 - AERMOD run for each SC temporal sector
 - Upwind spatial sector of direction being processed
- REFINE
 - Find overall maximum concentration from PROBE or FLOWSECTOR
 - Use meteorology and SC associated with maximum concentration
 - If terrain and/or downwash, use terrain heights and projected building dimensions of direction of maximum concentration
 - Refine receptor spacing to 1, 2, or 5 m increments

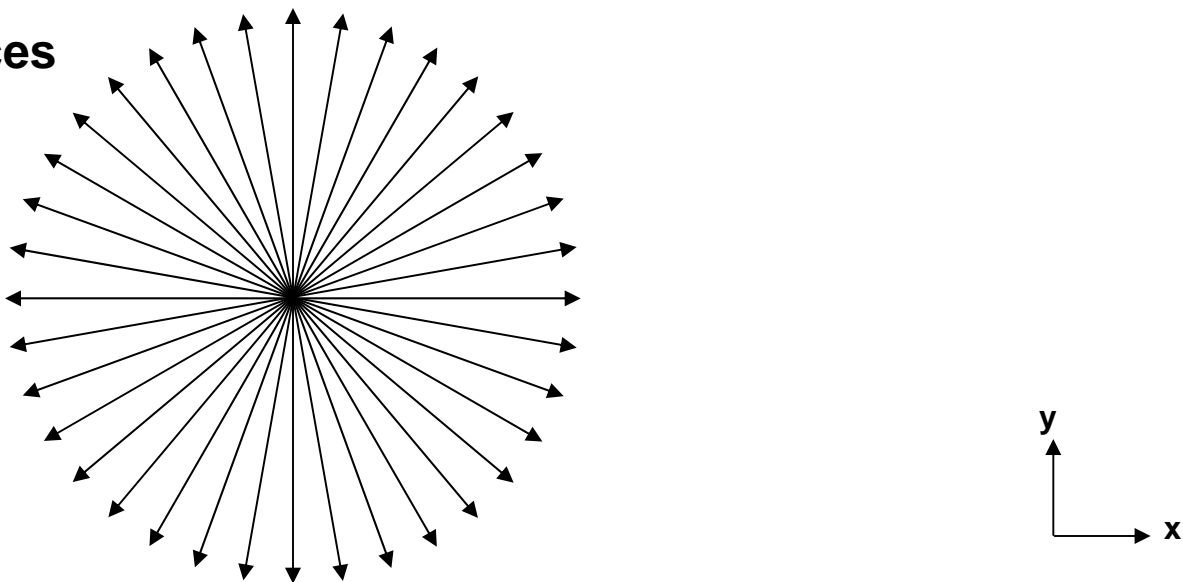
5 km



FLOWSECTOR: rectangular area



FLOWSECTOR: other sources



 ***** AERSCREEN MAXIMUM IMPACT SUMMARY *****

CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m3)	SCALED 3-HOUR CONC (ug/m3)	SCALED 8-HOUR CONC (ug/m3)	SCALED 24-HOUR CONC (ug/m3)	SCALED ANNUAL CONC (ug/m3)
-----	-----	-----	-----	-----	-----
ELEVATED TERRAIN	0.3652E+05	0.3652E+05	0.3287E+05	0.2191E+05	3652.

DISTANCE FROM SOURCE 139.0 meters directed toward 180 degrees
 RECEPTOR HEIGHT -5.02 meters

IMPACT AT THE
 AMBIENT BOUNDARY 0.1552E+05 0.1552E+05 0.1397E+05 9310. 1552.

DISTANCE FROM SOURCE 30.0 meters directed toward 110 degrees
 RECEPTOR HEIGHT -5.88 meters

Future

- Draft release package:
 - AERSCREEN and MAKEMET executables
 - User can download BPIPPRM, AERMOD, AERMAP and AERSURFACE from SCRAM website
<http://www.epa.gov/scram001>
 - User documentation and example case